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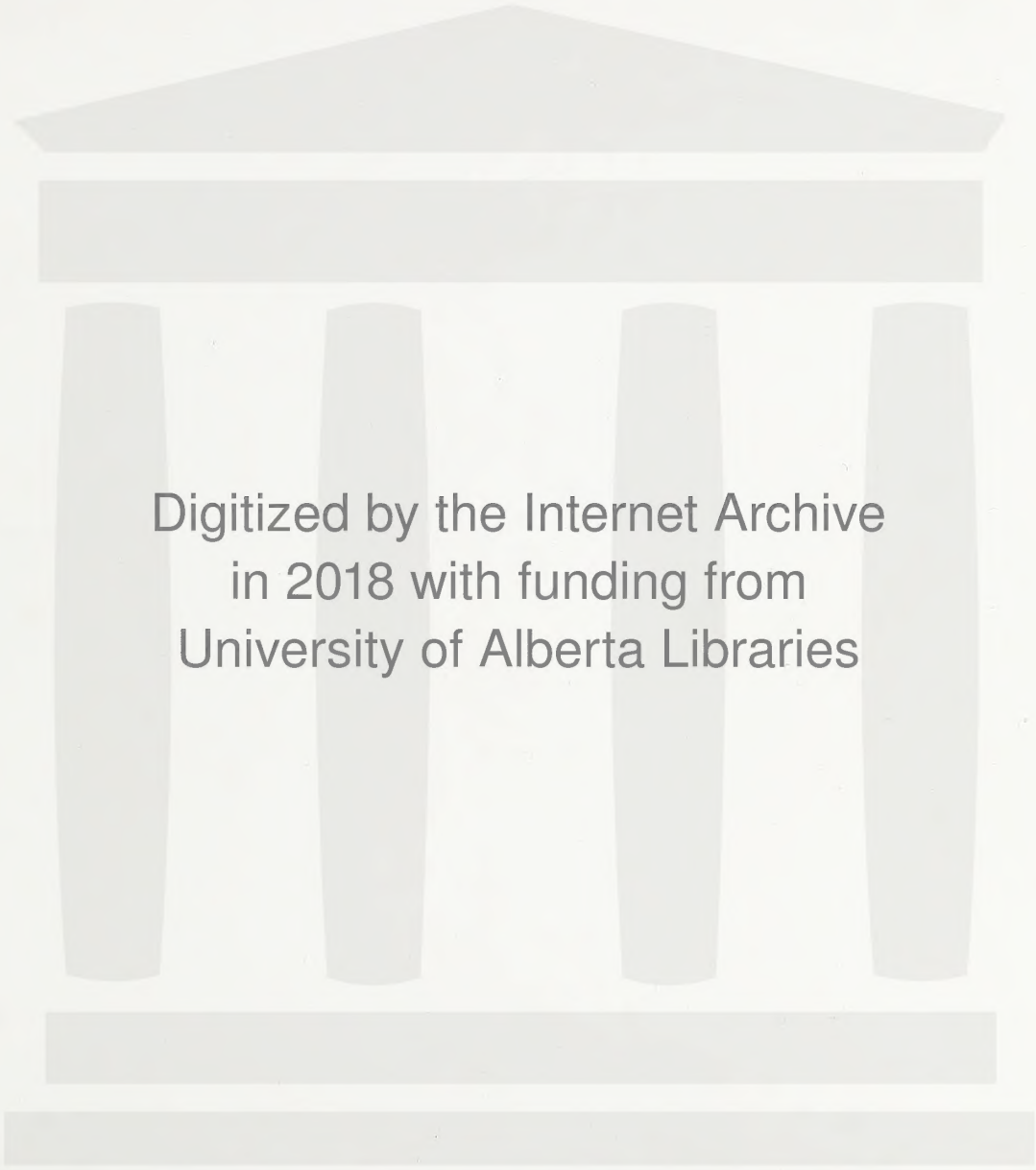
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THE UNIVERSITY OF ALBERTA

AN ANALYSIS OF THE ZONE TESTING PROGRAM IN CENTRAL ALBERTA

by

John Ephraim Reid

A Thesis

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ABSTRACT

The zone testing program in Central Alberta provides for the administering of zone-wide external examinations in Grades X and XI. These examinations are prepared by committees of zone teachers. The marks awarded on each examination constitute 50 per cent of the students' final score. The program was instituted in Central Alberta mainly for the purpose of attaining greater standardization of achievement, raising standards in the small schools, and providing a better basis for comparison in marking and grading. No external examinations were administered in Grades X and XI prior to the inception of this program.

The current study attempts to evaluate the zone testing program in terms of level of achievement. It compares the Mathematics and Social Studies marks of Grade XII zone students in 1959 with those of 1962. This period represents the first three years of the program's operation.

To assess the effect of a specific factor on achievement, the level of achievement must be measured, and the variables which have previously been found to affect achievement must be examined. Those variables which showed no significant difference in 1959 and 1962 are eliminated as possible causative factors in altering the level of achievement. Those factors which did show a significant difference in the two years are then assessed in relation to achievement.

Variables which did not differ significantly from 1959 to 1962 and are therefore not considered to influence pupil achievement are: pupil age, pupil mobility, promotion policy, class size, and school

organization. The variables which showed a significant difference and thus could affect pupil achievement are pupil scholastic ability, pupil attendance and teacher qualifications. The attendance was lower in 1962 than in 1959 and therefore could have resulted in a slight drop in achievement. Teacher qualifications in Mathematics and Social Studies improved during the period studied and therefore could help to raise the level of achievement. The 1959 Grade XII class was found to be superior in scholastic ability to the 1962 class. This factor would result in a lowering of achievement in 1962.

Achievement in Grade XII Mathematics and Social Studies in 1959 was found to be superior to that of 1962. However, the superiority of this same group at the Grade IX level was considerably more marked. There is therefore an indication that, in relation to scholastic ability, some improvement of achievement occurred, although no positive statistical proof can be established. This improvement may be attributed to improved teacher qualifications and the zone testing program.

As a result of this study certain proposals are made for improving and delimiting the zone testing program. The most important of these proposals are: (1) that further study be done on other aspects of the program; (2) that the program be adapted to diagnostic teaching; and (3) that the quality of the examinations be improved.

ACKNOWLEDGEMENTS

The writer is indebted to the Superintendents and Secretaries in the School Units of the Central Alberta Zone for the co-operation given in providing the necessary data for this study. The writer further wishes to acknowledge the assistance and advice given by Dr. H. T. Sparby, Dr. R. S. MacArthur and Dr. W. D. Neal.

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CHAPTER I

INTRODUCTION

The effectiveness of a school system has long been measured by the results attained by the graduates of that system on external examinations. It is generally recognized that examinations are one of the king-pins upon which educational practice revolves, providing they are not the ultimate goals of education. The Alberta Royal Commission on Education recommended that Departmental examinations continue in all schools in Grade IX;[1] that the Departmental examinations be maintained at the Grade XII level in all schools, and extended to all matriculation courses;[2] and that Departmental examinations be reinstated for all matriculation-program courses in Grades X and XI in all non - accredited schools and school systems; and that these examinations be made available for use at local discretion in accredited schools of school systems.[3]

Since external examinations in Grades X and XI have not been reinstated by the Central Authority of the Province, the Central Alberta Zone initiated its own external examination program in these

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[1] "Report of the Royal Commission on Education in Alberta," (Queen's Printer, 1959) p. 99.

[2] Ibid., p. 100

[3] Ibid., p. 100

grades.

PURPOSE OF THIS STUDY

The purpose of this study is to ascertain the effect of the zone testing in Grades X and XI on Grade XII examination results by comparing achievement and failure rates before and after the implementation of the testing program.

In this study there are many variables which must be considered in relation to these results. Among these variables are pupil scholastic ability, school size, class size, teacher qualifications, pupil age, pupil attendance and promotion policies. As these factors obviously influence achievement, this study attempts to assess their effect on comparative achievement, and thereby determine the net result of the testing program.

BACKGROUND FOR THE STUDY

History of Examination Practices in Alberta[4]

Practices in external examinations as administered by the Department of Education have varied widely during the past fifty-eight years. The external examination program shortly after the formation of the Department appears to have been both intensive and extensive in the

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[4]R. S. MacArthur and S. Hunka, "School Examination Practices and Standards in Alberta," Monographs in Education, No. 2, (The University of Alberta, Edmonton, 1959), pp. 3-22.

light of present practices. Examinations were administered in almost all subjects from the eighth to the twelfth grade inclusive. The final mark awarded to the student was based on a predetermined standard arbitrarily set by the examiner. Since different examiners set different papers, standards varied from one subject to another in a given year, and in a given subject over a period of years. Under this system the pass mark was 34 per cent of the possible raw score except for English in which 40 per cent was required. The number of failures ranged from 0 per cent to 40 per cent, depending upon the standards set by the examiner.

An aggregate system of marking was employed until 1924, at which time a unit system was adopted by the Department. Under the aggregate system a student had to obtain a certain aggregate score in order to receive an over-all pass for the year; under the unit system a student had to obtain only a specified score in each subject to secure a pass for the year. Thus it became possible to obtain credit for individual subjects, repeating only those which were failed. The system of passing by units according to standards set by individual examiners continued until 1936, when the unit system was replaced by the credit system, and the practice of scaling was introduced into marking procedure.

The credit system, introduced in 1937 and 1938, incorporates aspects of both of the earlier systems. A High School Diploma is issued to students who obtain a pass in subjects carrying a total of 100 credits. Senior matriculation is granted to students who secure

100 credits in an academic pattern with a minimum average of 60 per cent in the final year.

The scaling system of marking examinations has been in practice from its inception in 1936 to the present. By this system, the raw scores obtained by Grade XII students in each examination subject are arranged in five categories, with their relative positions remaining constant. After being thus arranged, they are then converted to scaled scores ranging from 0 to 100 as illustrated in Table I.

TABLE I

CONVERSION OF SCORES FOR EACH GRADE XII EXAMINATION

GRADING CATEGORY	PERCENTAGE	SCALED SCORE
H	5	80-100
A	20	65-79
B	35	50-64
C	25	40-49
D	15	0-39

Simultaneously with the introduction of the credit system, Grade X and XI Departmental examinations were discontinued, and promotion was entrusted to the teacher. In support of this procedure

Lloyd makes the following statement, "Ideally, it seems that the teacher who is trusted with the responsibility for teaching, and is competent to do so might also be trusted with the responsibility of examinations."[5] This practice of internal examinations in Grade X and XI gave considerable freedom to the teacher.

Related Literature

There is a dearth of research into the comparison of educational standards in Canada. Few studies have been conducted because records and results have not been preserved or are difficult to locate. Sansom, with the assistance of the Alberta Teachers' Association, conducted a testing program at the Grade X level in Alberta for the years 1943 through 1948.[6] This study tested approximately 1800 students each year representing every type of school where Grade X was taught. The subjects tested were Vocabulary, Mathematics, English, Science and Social Studies. Sansom reports that the general tendency through successive years was upward though most of the changes were small. In general his findings indicate the stability of achievement in elementary education in Alberta (Table II).

The decline in Social Studies is explained by the content of the

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[5]W. S. Lloyd, "The Role of Government in Canadian Schools," Quance Lectures, (Gage, 1959), p. 49.

[6]C. Sansom, "Sixth Statistical Report Grade X Survey Tests," (A. T. A. Magazine, June, 1950), pp. 28-33.

test. It placed emphasis on 1943 current events which would be unfamiliar to students in the later years. This pitfall illustrates one difficulty in obtaining Social Studies tests that are valid over an extended period of time. The following table shows the subjects tested and the mean scores for each year.

TABLE II

MEAN GRADE X SCORES REPORTED
BY SANSOM, 1943 - 1948

	MEANS 1943	MEANS 1944	MEANS 1945	MEANS 1946	MEANS 1947	MEANS 1948
VOCABULARY	32.23	31.46	31.71	31.88	31.99	31.06
MATHEMATICS	13.90	14.31	14.76	15.84	15.65	14.98
ENGLISH	73.44	73.78	73.71	74.30	75.30	75.77
SCIENCE	35.31	35.82	36.15	36.83	37.80	36.73
SOCIAL STUDIES	54.01	53.50	52.57	51.25	49.82	48.69

Partlow, in a comparison of standards of 1933-38 and 1952-54 students at St. Catherines, reports that there was a significant over-all improvement in Arithmetic and Reading in Grades V to VIII.[7]

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[7]H. R. Partlow, "Arithmetic and Reading Yesterday and Today," (Doctor's thesis, the University of Toronto, Copp-Clark, 1955), pp. 130-131.

This study revealed gains in both mechanical arithmetic and arithmetic problems.[8] In Reading, there was evidence that comprehension skills had improved. In Vocabulary, the Grade VIII pupils of 1953 had less skill in definition than those of 1933, whereas the pupils in 1953 in Grades V, VI and VII showed slight improvement over those of 1933.[9]

Other studies, although they do not compare educational standards, are relevant when one considers the variables associated with examination achievement. One of the variables which must be considered is pupil mobility. Nyberg,[10] in his study on mobility, concluded that there was no significant relationship between transiency and performance in any subject other than Social Studies. In this subject, a pupil's mark might be lowered if he transferred from one school to another, but the drop would not be alarming. A study closely associated with mobility was conducted by Frymier,[11] who found that incoming students were sometimes rejected simply because they had not been a part of the established group for a period of time. There is a possibility that rejection by the group could affect achievement. A third study, by

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[8] Ibid., p. 99.

[9] Ibid., p. 110

[10] V. R. Nyberg, "A Study to Determine the Effect of Transiency on Grade Nine Departmental Examination Marks," (Alberta Journal of Educational Research, Vol. 1-2, 1955-56), p. 155.

[11] J. Frymier, "Acceptance and Rejection as Related to Length of School Attendance," (Journal of Educational Research, Vol. 53, 1959-60), p. 114.

Ryan,[12] indicated that there was only a small positive relationship between acceptance and grades obtained. Mallett[13] states that a record of transiency prior to Grade X is unrelated to failure.

Another variable considered in the current study is that of teacher qualifications. Lindstedt[14] found that when the length of training of the teacher was less than four years, there was no significant relation between pupil achievement in Mathematics and the teacher's professional training. The relationship became significant when the length of training reached or exceeded four years. Lindstedt's study also investigated the relation between teaching experience and pupil achievement. When the teacher had only one year of experience or ten or more years, the relationship to student achievement became significant. He concluded by stating, "Teacher effectiveness is made up of the two faces of the same coin; one face is experience, the other is training. A considerable amount of polishing, (at least five years of experience and four years of training) is needed to produce any significant

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[12]F. J. Ryan and J. S. Davie, "Social Acceptance, Academic Achievement, and Academic Aptitude Among High School Students," (Journal of Educational Research, Vol. 52, 1958-59), p. 106.

[13]I. B. Mallett, "A Study of Factors Associated With Failure in Selected Subject Areas of Grade Ten and Eleven," (Unpublished Master's thesis, University of Alberta, Edmonton, 1963), p. 124.

[14]S. A. Lindstedt, "Teacher Qualifications and Grade IX Mathematics Achievement," (Unpublished Master's thesis, The University of Alberta, Edmonton, 1960), pp. 31-33.

brightening of the coin."[15]

Wasylyk, in a parallel study concluded that:

> There is some difference in mathematics examination results between students whose teachers have had less than four years of academic and professional training and students whose teachers have had four but less than five complete years of training. The student achievement of teachers with five but less than six years of training is not very much higher than that of teachers with four but less than five years of training. The student achievement of teachers with six or more years of training far surpasses that of every other group of teachers.[16]

Bergman studied factors related to pupil success or failure as measured on educational tests.[17] He found that years of teacher training has no appreciable influence on educational achievement within homogeneous groups.

In the studies conducted on the relations between teacher qualifications and student achievement, the authors concluded that practical experience is extremely vital to the development of a skilled teacher. They also conclude that achievement is significantly better among students whose teachers have four or more years of training than among those whose teachers possess less than four years of training.

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[15]Ibid., p. 51.

[16]E. Wasylyk, "Teacher Characteristics and Grade XII Achievement," (unpublished Master's thesis, the University of Alberta, Edmonton, 1961), p. 42.

[17]W. S. Bergman, "The Determination of Norms," (Doctor's thesis, The University of Michigan, Ann Arbor, Michigan, 1929), p. 167, cited by H. M. Walker, "The Measurement of Teaching Efficiency," (New York, Mcmillan Co. 1935), p. 146.

This fact was recognized by the Alberta Royal Commission in its recommendation that all teachers have a minimum of four years of training including a degree.[18]

Two other variables which are thought to affect achievement, attendance and class size, were investigated by Clarke,[19] in a study of relative achievement in two Alberta cities. The investigation found a difference in achievement but did not attribute any of it to attendance, because the district which had a lower mean attendance consistently had a higher achievement in each of the four years studied. In the city where classes were consistently smaller, achievement was better. It was concluded that smaller class size together with improved teacher qualifications resulted in higher student achievement.

Collins,[20] in a survey of the research on class size, made the following statement:

> Most of the research studies between 1900 and 1940 used pupil achievement in content subjects as the criterion for establishing a relationship between effective instruction and class size. The nature of the findings and inferences was in marked contrast to the trends in opinion for (although there appears to be some conflict)

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[18]"Report on the Royal Commission on Education in Alberta," op. cit., p. 276.

[19]S. C. T. Clarke and S. Richel, "The Effect of Class Size and Teacher Qualifications on Achievement." Research Monograph, No. 5, (The Alberta Teachers' Association, Edmonton, 1963), pp. 70-72.

[20]C. P. Collins, "Teaching Load - A Survey of the Literature," (Canadian Research Digest, No. 8, 1960), p. 174.

> the results of the studies would indicate that, under typical conditions, class size by itself appears to be unimportant as a factor in assessing effectiveness of instruction.

Age must be considered as a variable in relation to achievement on examinations. Mallett[21] states that being over-age for the grade and having repeated one or more grades prior to entering Grade X is related to failure.

The aforementioned literature, although relevant, does not parallel this study. There was no research discovered which compared the achievement of students over a period of years in relation to examination practice. This study therefore undertakes to make such a comparison in two specific subject fields.

THE CENTRAL ALBERTA ZONE TESTING PROGRAM

Origin of the Program

The testing program in the zone was a direct outgrowth of departmental examination policy from 1938 to 1959. Some of the advantages of internal testing in Grades X and XI have previously been pointed out. However, over an extended period of time, certain unfavourable trends developed. One of these trends appears in the difference in achievement between the small and the large high schools. The accuracy of assessing achievement is usually inferior in the smaller high school. The Cameron Commission Report states:

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[21] I. B. Mallett, op. cit., p. 122.

> The best judgments of experienced educators is that in many smaller high schools, and indeed even in others staffed by poorly qualified teachers, little confidence can be placed in the teachers' estimates of adequate achievement...Smaller high schools generally overgrade their pupils and claim undue success in grades X and XI, while they suffer depressing failure rates in grade (sic) XII Departmental examinations.[22]

Lloyd also points out the inadequacy of promotion policy in the small school. He states, "In the small high school in which ready professional consultation is difficult, if not impossible, in which comparison of standards is difficult, and in which the availability of experienced and well-prepared professional staff is less certain, the external examination may be a necessity if standards are to be known and students interests protected."[23]

During the period when no external examinations were administered, a great disparity existed in the testing procedures used by different teachers. In some schools no examinations were administered; in some, a few students had to write, and in others, all students were required to write. Tests set by different teachers in the same subject were diverse in level of difficulty.

Public criticism of the schools became more articulate, and with the renewed emphasis on Education in general and Science in particular, some of our educational practices began to be questioned. Studies to assess and suggest improvements in educational practice were undertaken.

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[22]"Report of the Royal Commission on Education in Alberta," op. cit., p. 99.

[23]W. S. Lloyd, op. cit., pp. 47-48.

The Cameron Commission assumed this duty in Alberta. One of the aspects of educational practices which came in for a thorough examination was the external testing program. Teachers, principals and superintendents requested a system which would bring greater uniformity of standards in examination practices. As a result the zone testing program was initiated. The pendulum had swung to its farthest extremity in allowing freedom from external examinations; it now began to swing back.

Purpose of the Program

The zone testing program was initiated in an attempt to overcome the variation in testing and grading practices. It was proposed that the program be wide enough in scope so that all teachers would benefit. The proposal for the program set forth the following aims:

1. to establish a greater degree of standardization of academic achievement in Grades X and XI.
2. to increase the level of achievement in the small high schools to more nearly equal that of the larger schools.
3. to provide a better basis for comparison of achievement for teachers in the smaller schools.
4. to provide an in-service training program for teachers and principals in the preparation, marking and analysis of tests.
5. to encourage a more thorough coverage of the subject content, as outlined in the curriculum guide.

Inherent in the imposition of an external examination program were three main dangers. The first of these was the possibility of interfering with the professional freedom of the teacher. To safeguard against this pitfall, all teachers were consulted prior to the

implementation of the program. Their reaction to the suggested program was generally favourable. Most of them felt that such a program would not greatly hamper their freedom if they were to play an integral part in the preparation and grading of the tests. The second danger was that the testing program could interfere with adaptation of the curriculum to local conditions and individual differences. The third danger was that such a testing program could alter the curriculum by indirectly specifying objectives and content in the subject areas. However, because of the reasons previously stated and the apparent teacher interest the superintendents of the zone initiated the program, using teacher-made examinations. The results of the examinations were to constitute 50 per cent of the student's total mark.

Scope and Operation of the Program

The examination project was planned and organized at zone meetings of superintendents representing the following school units: Camrose, Castor, Killam, Lacombe, Neutral Hills, Ponoka, Provost, Red Deer, Rocky Mountain House and Stettler. At these meetings the preparation of tests was arbitrarily assigned to the various school units, an examination schedule was drawn up, and regulations for marking and analysis were adopted.

The superintendent in each inspectorate selected a committee of competent teachers who were currently teaching the subject to prepare the examination and answer key. Considerable freedom was given to these committees regarding the type and content of the tests, with only a few

guiding principles set forth. It was stipulated that the examinations should try to test the student's skill, knowledge, comprehension, and application of knowledge. The tests which were prepared were generally factual and objective, with a view to more accurate marking.

In most school units marking was conducted at group sessions to facilitate consultation and insure greater intermarker reliability. In other school units, where teachers marked individually, a conference was held to discuss the marking of the examination. In all cases the examination was marked according to the marking key provided by the committee of teachers who prepared the test.

The school subjects and number of students tested in the three years of the program's operation are shown in Table III.

TABLE III

SCOPE OF THE CENTRAL ALBERTA ZONE TESTING PROGRAM

SUBJECT	NUMBER OF CANDIDATES		
	1960	1961	1962
Language 10	1215	1949	1571
Social Studies 10	1333	2046	1628
Mathematics 10	1441	1587	1474
Science 10	1421	1605	1455
Language 20	1590	1141	1482
Social Studies 20	1499	1156	1438
Mathematics 20	993	1144	1122
Science 20	1016	1170	1125
French 20	889	932	941

After the tests had been marked, representatives of the various school units met in Stettler to compile zone frequency distributions for each subject, and to prepare conversion tables. To do this, maximum and minimum scaled scores for each of the letter gradings were established, as shown in the following table:

TABLE IV

DISTRIBUTION OF GRADE X AND XI ZONE STUDENTS

LETTER GRADINGS	1960 PERCENTAGES GR. X & XI	1961-62 PERCENTAGES GR. X	GR. XI	SCALED SCORES
H	10	10	8	80-100
A	25	25	22	65-79
B	40	35	35	50-64
C	18	20	25	40-49
D	7	10	10	0-39

The procedure followed in the analysis was to assign a scaled score of 0 to a raw score of 0 and a scaled score of 39 to a raw score equivalent to the tenth percentile (seventh percentile in 1960). The maximum and minimum raw scores corresponding to the limits of the other letter gradings were then determined and plotted on a graph. Scaled scores corresponding to the raw scores were then ascertained by linear interpolation within each letter grading. Tables showing the raw scores and their transmuted scaled scores were constructed and forwarded to each school within the zone.

HYPOTHESIS FOR THIS STUDY

Inherent in the implementation of the zone testing program was the assumption that the level of student achievement would be raised. Therefore this study makes the hypothesis that the zone testing program was influential in improving student achievement, despite evidence of the effect of other factors on achievement.

METHOD OF STUDY

This research will study the effect of the zone testing program on achievement by comparing the Mathematics and Social Studies scores obtained by the Grade XII students in all zone high schools in 1959 and 1962. However, achievement is affected by many extraneous variables which must be considered before specific results can be evaluated. The research method used is that of eliminating those factors previously found to be associated with achievement which do not differ significantly for the two school years. Factors associated with achievement which differ significantly must therefore be considered in assessing the results of the zone testing program since they must cause the difference in achievement.

Variables such as school libraries, audio-visual aids and socio-economic status are not compared, primarily because a general knowledge of the zone indicates no marked difference over such a short period of years, and secondarily because of the time and expense involved. It is unlikely that any other factors would be of sufficient magnitude to

result in any marked difference in achievement in the two years.

DELIMITATIONS OF THE STUDY

This study will be limited to an investigation of the testing program in the Central Alberta Zone. Although the program has been partially or fully instituted in other areas recently, Central Alberta has been chosen because of the availability of the data. In this area, the system has been in force long enough to obtain Grade XII Departmental results for students who have attended three years of high school under the program.

This study will also be limited to an investigation of only two of the subject areas included in the testing program. The field of Social Studies has been selected since it is one of the requisites for a High School Diploma. Mathematics has been chosen as representative of the electives in the field of science.

Another limitation of the study is that it will assess only one of the aims of the testing program, the improvement of student achievement.

This study will be further limited to those Grade XII students in the years 1958-59 and 1961-62 who took their Grade IX in Alberta.

All high schools within the area are included in this study with the exception of two which were on a semester organization and did not participate in the testing program in 1961-62 and 1962-63.

BASIC ASSUMPTIONS

Several sources were used for the collection of the necessary data. Among these were the Form A cards of the Department of Education, The Teachers' Report on Qualifications, Salary and Experience, and the files of the Secretary Treasurers in the various school units. On the Form A card are listed: subjects being offered, number of students registered in each course, names and certification of teachers, subjects taught by each teacher, and classification of school. It is assumed that the information obtained from these sources is accurate.

It is assumed that the Grade X and XI examinations held in each of the three years in Mathematics and Science were of comparable difficulty, and that they contained the same proportion of questions involving the retention of knowledge to those involving the application of knowledge.

Another assumption is that the teachers in the zone followed the prepared keys in the marking of the zone examination papers in each of the three years.

It is also assumed that the teachers used 50 per cent of the score obtained on the Grades X and XI zone tests to calculate the student's final mark.

It is assumed, finally, that the ability and achievement of the students in the province as a whole remained relatively constant in 1958-59 and 1961-62.

CHAPTER II

COLLECTION AND ANALYSIS OF DATA

In the Central Alberta Zone there were 691 students registered in at least one of the investigated subject areas in 46 classrooms during the 1958-59 school year. Of this total, 671 students were registered in Social Studies 30, and 424 in Mathematics 30. During the 1961-62 school year there were 1048 students in one or both subjects of whom 992 students were receiving instruction in Social Studies 30 and 641 in Mathematics 30.

In this study the levels of confidence of the means are calculated by two methods, in order to accept or reject the null hypothesis.

Firstly, the standard error of the means formula[24]

$$SE_m = \frac{\sigma}{\sqrt{N}}$$

is used to establish the .95 and .99 confidence limits.

Secondly, the critical ratio test[25]

$$CR = \frac{D}{SE_D}$$

is used at the .05 and .01 levels of significance.

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[24] H. E. Garrett, "Statistics in Psychology and Education," (Longmans, Green and Company, Toronto, 1948), p. 185.

[25] Ibid., p. 215.

COMPARATIVE ACHIEVEMENTS

All Grade XII students in Alberta who are registered in a particular subject write the same examination at the end of June. The Departmental Examinations, set by a committee of teachers and specialists, are based on a common Province-wide curriculum for each subject. These examinations are conducted under the direction of the University Entrance Examination Board. The same examination papers are never administered twice, but there is a continuity in the pattern from year to year. Although the papers are intended to be comparable in difficulty, some difference inevitably occurs from year to year. The writing of the examination is supervised under stipulated conditions with explicit rules and regulations.

The records of the Department of Education have provided scaled achievement scores for all students who wrote Grade XII examinations in the years 1959 and 1962. The scores used in this study are for the entire groups in each subject, rather than sample groups.

Table V and Table VI show that the Provincial means in both Mathematics 30 and Social Studies 30 remained relatively constant during the two years studied. However, the means obtained by the students in the Central Alberta Zone altered considerably.

In 1959 the mean score obtained by the zone students in Mathematics 30 was 2.29 points above the mean for the Province. If this had been a random sample, a difference this large would be significant at the .01 level. In 1962 the mean score of 52.92 obtained by the

students in the zone was .68 below the mean for the Province. A difference this small would not be significant in a random sample.

In Social Studies 30 the mean score obtained by the students of the zone in 1959 was 1.39 points below the mean for the Province, whereas in 1962 the zone students scored 4.43 points below the Provincial mean. If the two zone groups had been samples, a difference of 1.39 would be significant at the .05 level, but a difference of 4.43 would be significant at the .01 level. In both years, then, the zone students had a significantly lower achievement than those of the Province.

From Table V it is evident that the 1962 mean scaled scores for the Province (53.60) in Mathematics was .34 points above that of the Province in 1959 (53.26). This scaled score difference is not significant. The 1962 mean scaled score obtained by the students in the zone (52.92) was 2.63 points below that of the zone in 1959 (55.55). This difference is significant at the .01 level.

Table VI shows that the 1962 mean scaled score for the Province (54.15) in Social Studies was .16 points below that of the Province in 1959 (54.31). This scaled score difference is not significant. The 1962 mean scaled score obtained by the students in the zone (49.72) was 3.20 points below that of the zone in 1959 (52.92). This difference is significant at the .01 level.

TABLE V

ANALYSIS OF PROVINCIAL AND ZONE SCORES IN MATHEMATICS 30

	YEAR	NUMBER OF STUDENTS	MEAN SCALED SCORE	STANDARD DEVIATION	DIFFERENCE BETWEEN MEANS	DIFFERENCE CRITICAL VALUE	
						.05	.01
PROVINCE ZONE	1959 1959	5252 424	53.26 55.55	16.74 16.30	2.29	1.59	2.08
PROVINCE ZONE	1962 1962	7830 641	53.60 52.92	16.34 16.66	.68	1.27	1.67

TABLE VI

ANALYSIS OF PROVINCIAL AND ZONE SCORES IN SOCIAL STUDIES 30

	YEAR	NUMBER OF STUDENTS	MEAN SCALED SCORE	STANDARD DEVIATION	DIFFERENCE BETWEEN MEANS	DIFFERENCE CRITICAL VALUE	
						.05	.01
PROVINCE ZONE	1959 1959	8072 671	54.31 52.92	14.87 14.78	1.39	1.12	1.47
PROVINCE ZONE	1962 1962	11592 992	54.15 49.72	14.88 13.48	4.43	.93	1.21

According to Table VII the percentage of zone students who obtained C and D gradings in Social Studies in 1959 and 1962 was greater than that given by the Department of Education, Table I, page 4. The

percentage of zone students who received an H or an A grading in Social Studies was much higher in 1959 than in 1962, whereas the percentage who got a D grading was much lower.

In Mathematics the percentage of zone students who were granted an H or an A grading was higher in 1959 than in 1962, whereas the percentage who received a D was lower.

TABLE VII

PERCENTAGE DISTRIBUTION OF ZONE SCORES IN SOCIAL STUDIES 30 AND MATHEMATICS 30

	SOCIAL STUDIES		MATHEMATICS	
	1959	1962	1959	1962
H	3.3	2.1	5.4	5.2
A	21.3	16.0	25.9	18.4
B	31.0	32.2	33.0	34.5
C	28.8	27.0	25.3	25.4
D	15.6	22.7	10.4	16.5

The difference in achievement is further illustrated by the chi-square test[26] which compares the observed frequencies in each letter grading with the expected frequency, using the percentages in Table I, page 4. Since a chi-square of 14.16 (Table VIII) is significant at the .01 level, the greater percentage of Mathematics students in the zone

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[26] Ibid., p. 254.

who received an A grading and the lower percentage who received a D is significant; therefore the null hypothesis must be rejected. It may then be concluded that in 1959 the achievement of the zone students was significantly above that of the Province.

TABLE VIII

DIVERGENCE OF OBSERVED AND EXPECTED ZONE FREQUENCIES IN MATHEMATICS 30 FOR 1959

	H	A	B	C	D
OBSERVED	23	110	140	107	44
EXPECTED	21	85	148	106	64

$X^2 = 14.16$ df = 4 P = less than .01

Since a divergence of 2.23 (Table IX) from the null hypothesis can be expected to occur upon repetition about 70 per cent of the time, the chi-square is not significant, and the null hypothesis must be retained. Therefore, in 1962, there was no significant difference between the percentages of students who received each of the letter gradings in Mathematics in the zone and in the Province.

TABLE IX

DIVERGENCE OF OBSERVED AND EXPECTED ZONE FREQUENCIES IN MATHEMATICS 30 FOR 1962

	H	A	B	C	D
OBSERVED	33	118	221	163	106
EXPECTED	32	128	224	160	97

$X^2 = 2.23$ df = 4 P = .70

The observed letter grading frequencies in Social Studies (Tables X and XI) differ significantly from the expected frequencies in both 1959 and 1962. Therefore, the Social Studies achievement in the zone was significantly below that of the Province in both years. Since the 1962 chi-square is more than that of 1959, there was a greater divergence of the zone frequency from that of the Province in 1962. This fact indicates that the zone achievement was below that of 1959.

TABLE X

DIVERGENCE OF OBSERVED AND EXPECTED ZONE FREQUENCIES IN SOCIAL STUDIES FOR 1959

	H	A	B	C	D
OBSERVED	22	143	208	193	105
EXPECTED	33	134	234	168	102

$X^2 = 10.86$ df.= 4 P is between .05 and .04

TABLE XI

DIVERGENCE OF OBSERVED AND EXPECTED ZONE FREQUENCIES IN SOCIAL STUDIES FOR 1962

	H	A	B	C	D
OBSERVED	21	159	319	268	225
EXPECTED	50	198	347	248	149

$X^2 = 66.6$ df = 4 P is less than .01

In summary, it may be concluded from a study of Tables V to XI inclusive that the Mathematics and Social Studies achievement of the 1962 Grade XII class was significantly lower than that of the 1959 Grade XII class.

VARIABLES ASSOCIATED WITH ACHIEVEMENT

Scholastic Ability

All Grade IX students in the Province are required to write the School and College Ability Test, Level 3, (S.C.A.T.) as part of the Departmental examination battery. This test undertakes to measure the developed abilities most closely related to success in school learning, rather than innate intelligence. It yields three separate scores. Verbal scores are based on two sub-tests, Sentence Understanding and Word Meaning. Quantitative scores are also based on two sub-tests, Arithmetic Computations and Numerical Problem Solving. The third score used in this study is the total score obtained on the two tests expressed as a percentile..

The S.C.A.T. scores, together with the Departmental scores in all subjects, assist in the prediction of student success in further academic courses. Black states, "It can be concluded from Table I that it is possible to predict success in related University freshman courses on the basis of Grade IX results with a sufficient degree of accuracy that such predictions could be of real value in the guidance program in the early high school years."[27] Unfortunately, many schools cannot fully utilize the results of the Grade Nine tests. Small high schools which employ fewer than five teachers can provide little more than a matriculation program with a few general and commercial courses. In these schools the student must take many subjects which his ability and aptitude should preclude. Even the larger high schools often fail to use the Grade Nine scores for the greatest benefit in assisting students with the selection of courses. Byrne states, "less than 15% of composite high school students in Alberta follow a technical program, while 50 to 60% of high school students select the matriculation program. Yet only 5 to 7% of the total student population gain a matriculation standing."[28] It was also discovered in a study of Calgary high schools that far too little use was being made of Grade IX results for the prediction of

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[27]D. B. Black. "The Prediction of University Freshman Success Using Grade IX Departmental Examination Scores." The Alberta Journal of Educational Research, Vol. V, No. 4, (Dec. 1959), p. 234.

[28]T. C. Byrne. "Composite High Schools in Canada," edited by J.M. Andrews and A. F. Brown, (Edmonton Committee on Educational Research, Faculty of Education, University of Alberta, 1959), p. 73.

success or failure in high school courses.[29]

Some of the 1959 Grade XII students completed Grade IX in 1955 although the majority wrote Grade IX in 1956. The 1962 Grade XII class included students who wrote Grade IX in 1958 and 1959 (Table XII). Of the 616 students who completed Grade IX in 1956, fifteen did not write the School and College Ability tests. In 1959 there were six such students. Because of this lack, the results obtained for the S.C.A.T. tests are incomplete.

TABLE XII

YEAR OF WRITING GRADES IX AND XII
(ZONE STUDENTS)

	GRADE IX				GRADE XII	
	1955	1956	1958	1959	1959	1962
NO. OF STUDENTS	75	616			691	
NO. OF STUDENTS			144	904		1048

In 1955 the Grade IX students wrote the Dominion Test of Learning Capacity, Form A. In 1956 the Grade IX students wrote both the Dominion Group Test of Learning Capacity, Form B, and S.C.A.T. Form 3A tests. A correlation of .824 was found between these two tests.[30] Since no

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[29]D. B. Black, R. S. MacArthur and J. G. Paterson, "Pupil Personnel in Alberta Secondary Schools," Monographs in Education, No. 6 (The University of Alberta, Edmonton, 1961). pp. 19-24.

[30]Report on the Reading Test and Ability Tests Administered 1956, (Department of Education, Province of Alberta), p. 7.

correlation was calculated between Form A of the Dominion Test and the S.C.A.T. tests, it is assumed that a correlation as high as .824 would obtain. However, the statistical use of this information would have weaknessess.

From Tables XIII and XIV it is evident that on the S.C.A.T. ability tests the Grade XII class of 1959 was superior to the 1962 class. The mean scores of the 1955 and 1956 Grade IX students (1959 Grade XII students) were 3.22 and 1.6 respectively below those of the Province. A difference of 3.22 would be significant at the one per cent level, whereas 1.6 would not be significant. The mean scores of the 1958 and 1959 Grade IX students, (1962 Grade XII students), were 12.88 and 9.96 below those of the Province. If these had been sample groups, the difference in the means would be significant at the one per cent level. The 1959 Grade XII students in the zone were therefore a representative group of the Province, whereas the 1962 Grade XII class was not.

TABLE XIII

DOMINION GROUP TEST OF-LEARNING CAPACITY
INTERMEDIATE - 1950 EDITION - FORM A
JUNE 1955

	NUMBER OF STUDENTS	MEAN SCORE	STANDARD DEVIATION	DIFFERENCE BETWEEN MEANS	DIFFERENCE CRITICAL VALUE (.01 Level)
PROVINCE	13,795	52.79	10.60	3.22	3.17
ZONE	75	49.57	25.83		

TABLE XIV

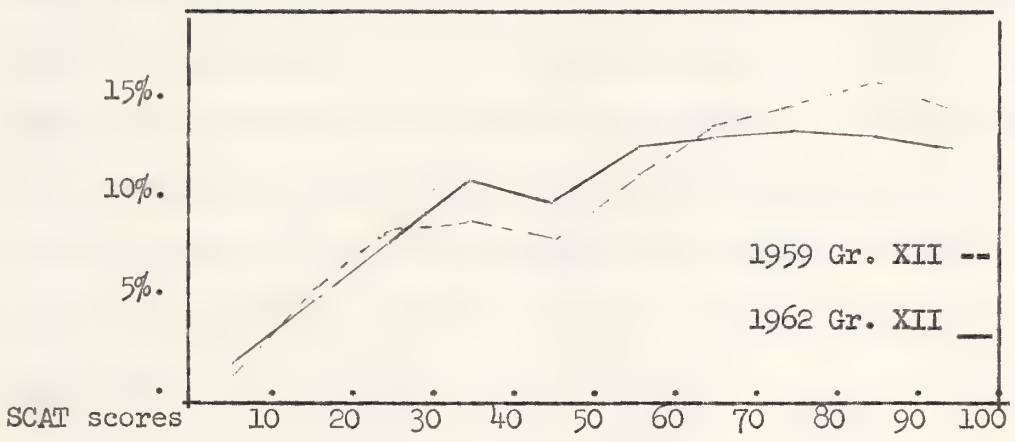
SCHOOL AND COLLEGE ABILITY TEST TOTAL SCORES
FORM 3A (1956, 1958) FORM 3B (1959)

	YEAR	NUMBER OF STUDENTS	MEAN SCALED SCORE	STANDARD DEVIATION	DIFFERENCE BETWEEN MEANS	DIFFERENCE CRITICAL VALUE (.01 Level)
PROVINCE ZONE	1956	14,857 601	64.32 62.72	17.80 24.25	1.6	1.85
PROVINCE ZONE	1958	17,434 144	65.57 52.69	17.76 21.62	12.88	3.82
PROVINCE ZONE	1959	17,830 898	70.18 60.22	18.01 24.86	9.96	1.55

Figure I illustrates the percentage of students who obtained scores within each of ten S.C.A.T. groups for the two years. The percentage of students in the bottom three groups differs very little for the two years, i.e., only .5 per cent in total. In the higher groups, however, the differences in percentage are significant. The percentage of students in 1962 who scored in the 30-39, 40-49, 50-59 groups is considerably higher than in 1959. The percentage of the 1962 students in the 60-69 and higher groups is considerably lower than in 1959.

FIGURE I

PERCENTAGE OF ZONE STUDENTS IN SCAT SCORE GROUPS
(1959, 1962)



A study of the tables relating to the S.C.A.T. scores reveals that the 1959 Grade XII class in the zone was superior in ability to that of 1962. Since the tests measure abilities developed before the end of Grade Nine, the difference might be partially the result of poorer teaching received by the latter class. This difference might also be the result of a greater number of drop-outs in the 30-60 S.C.A.T. groups for the 1956 Grade IX class. The difference in ability, insofar as it can be measured by achievement, is further illustrated by the achievement in Grade IX Mathematics and Social Studies.

Table XV shows that the achievement in Grade IX of the 1959 Grade XII class was greatly superior to that of the 1962 Grade XII class in both subjects. In Mathematics, 21 per cent of the 1959 Grade XII class received B and C gradings in Grade IX as compared to 32 per cent of the 1962 Grade XII students. In Social Studies, 41 per cent of the 1959

Grade XII class made B and C gradings in Grade IX as compared to 50.5 per cent of the 1962 Grade XII class. Many more Mathematics students of the 1962 Grade XII class obtained scaled marks in stanines 4 and 5. In Social Studies, more students of the 1962 Grade XII class obtained scaled marks in stanines 3, 4, and 5. The probability of success in gaining a high school diploma is 3, 12 and 25 in stanines 3, 4, and 5 respectively; the probability of obtaining a senior matriculation is .3, 0 and 3 in these stanines.[31] Thus the students of the 1962 Grade XII class had a lower probability of success in securing a senior matriculation than the 1959 class.

TABLE XV

PERCENTAGE OF ZONE STUDENTS OBTAINING
EACH LETTER GRADING IN GRADE IX
DEPARTMENTAL EXAMINATIONS

	MATHEMATICS		SOCIAL STUDIES	
	1959 GR. XII CLASS	1962 GR. XII CLASS	1959 GR. XII CLASS	1962 GR. XII CLASS
H	28.54	21.37	15.35	12.90
A	50.00	45.86	42.18	35.79
B	19.10	29.80	32.93	37.80
C	2.12	2.50	8.20	12.70
D	.24	.47	1.34	.81

[31] "A Study of the Success in High School of the Students Who Wrote the June, 1956 Grade IX Final Examination," Department of Education, Province of Alberta, June, 1961. Table XII, p. 11.

Age and Attendance

In June, all teachers compile a summary of data which indicates the age of each student at June 1 and the number of days he attended for each month, as well as his total attendance for the year. Copies of these summaries were used in compiling data regarding age and attendance. Attendance data were calculated for the entire group of students, since it was impossible to determine in which subject absences occurred. The total possible teaching days were 199 in 1958-59 and 198 in 1961-62. The mean attendance for the zone was 182.9 days in 1958-59 and 175.5 days in 1961-62 (Table XVI).

TABLE XVI

ATTENDANCE RECORD OF ZONE GRADE XII STUDENTS

	NUMBER OF STUDENTS	MEAN NUMBER OF DAYS ATTENDED	STANDARD DEVIATION	NO ATTENDANCE RECORD
1958-59	680	182.9	14.6	11
1961-62	1036	175.5	14.1	12

The difference of 7.4 days between the mean attendance for the two years is significant at the .01 level. It must therefore be concluded that the superiority in achievement of the 1958-59 students over the 1961-62 students could be partly attributed to better attendance.

The ages of Grade XII students for the two years are compiled separately for Social Studies and Mathematics. Table XVII indicates a

mean difference in age of .06 years for Social Studies and .04 years for Mathematics, neither of which is significant. Age difference can therefore be eliminated as a possible cause of superior achievement.

TABLE XVII

AGE OF ZONE GRADE XII STUDENTS

	NUMBER OF STUDENTS	MEAN AGE	STANDARD DEVIATION	NO AGE RECORD	CRITICAL RATIO
SOCIAL STUDIES 30					
1958-59	662	17.86	.89	9	1.5
1961-62	959	17.92	.75	33	
MATHEMATICS 30					
1958-59	419	17.86	.84	5	1.3
1961-62	623	17.90	.75	18	

Pupil Transfers

Another variable which must be considered is that of pupil mobility. The present study will consider only those students who completed Grade IX in Alberta and subsequently transferred into one of the zone high schools.

Table XVIII shows the scores in the S.C.A.T. test, Mathematics 30, and Social Studies 30, of the students who transferred into the zone high schools. In both years the students who transferred had a higher mean score in Social Studies and a lower score in Mathematics than the zone students. However, only in the 1962 Social Studies examinations was the difference significant. Since this group represents less than one per cent of the students registered in Social Studies in 1962, their superior achievement is relatively unimportant.

TABLE XVIII

NUMBER OF STUDENTS TRANSFERRING INTO THE ZONE AND THEIR TEST SCORES

	NUMBER OF STUDENTS	S.C.A.T. SCORES		MATHEMATICS 30 MEAN SCORES	SOCIAL STUDIES 30 MEAN SCORES
		3A MEAN	3B MEAN		
1958-59	9	64.44		54.91	53.37
1961-62	10		70.00	51.83	53.22

The difference in level of achievement of students transferring into the zone cannot therefore be considered as a causative factor in the superior achievement of one of the two Grade XII classes.

Teacher Qualifications

Qualifications of teachers is another variable relevant to the current study as it is often considered to be an objective measure of potential student performance. For the purposes of this study, teacher qualifications refers to a combination of the years of teacher education beyond Grade XII, plus years of teaching experience. As certificates are not always an accurate index of years of teacher education, reference is made to the number of years of professional training rather than to certification.

Tables XIX and XX show the qualifications of all high school teachers in the zone who taught high school subjects during the indicated years.

From Table XIX it can be seen that the percentage of teachers

having less than two years of professional training increased by 2.6 per cent over the four year period. The percentage of teachers with less than four years of training increased by 1.6 per cent over the same period, while the more highly trained groups with four or more years of training showed a corresponding decrease of 1.6 per cent. It must be noted, however, that the number of teachers with six or more years of professional training increased by 1.4 per cent during this time.

TABLE XIX

YEARS OF PROFESSIONAL TRAINING OF
ZONE HIGH SCHOOL TEACHERS

YEARS OF TRAINING	1958-59 No. %	1959-60 No. %	1960-61 No. %	1961-62 No. %
Less than 2 years	17 8.6	17 7.5	22 8.6	30 11.2
≥ 2 yrs. <3 yrs.	20 10.1	24 10.6	31 12.1	28 10.4
≥ 3 yrs. <4 yrs.	27 13.6	33 14.6	36 14.1	33 12.3
≥ 4 yrs. <5 yrs.	91 46.0	99 43.8	118 46.1	119 44.2
≥ 5 yrs. <6 yrs.	34 17.2	35 15.5	35 13.6	43 16.0
Greater than 6 yrs.	9 4.5	18 8.0	14 5.5	16 5.9
TOTAL	198	226	256	269

It is evident that the number of teachers with few years of training has increased, particularly the number with less than two years, while the number with 3-5 years of professional training has decreased. This trend, however, is reversed for the groups who have six or more years of training. From Wasylyk's conclusion (Page 9), it may be inferred that the increase in the number of teachers having more than six years of

training could result in an improvement in student achievement.

Table XX indicates that the number of years of experience of high school teachers in the zone has dropped considerably over the four-year period. The percentage of teachers having three years of experience or less increased each year, the number in the final year more than doubling that of the first. The percentage of teachers having four to six years of experience also increased. There was a corresponding decrease in the number of teachers having seven or more years of experience. Since teacher experience has been found to affect student achievement (Lindstedt, page 8), this trend toward less experienced high school teachers could result in a decline in student achievement.

TABLE XX

YEARS OF EXPERIENCE OF ZONE
HIGH SCHOOL TEACHERS

YEARS OF EXPERIENCE	1958-59		1959-60		1960-61		1961-62	
	No.	%	No.	%	No.	%	No.	%
0-3	18	9.1	25	11.1	43	16.8	50	18.6
4-6	22	11.1	27	11.9	27	10.5	42	15.6
7-9	30	15.2	29	12.8	33	12.9	20	7.4
10+	128	64.6	145	64.2	153	59.8	157	58.4
TOTAL	198		226		256		269	

Table XXI shows that in 1958-59, 7.2 per cent of the teahhers of Mathematics 30 had less than four years of professional training as compared to 4.9 per cent in 1961-62. In 1958-59, 28.6 per cent had more

than five years of training as compared to 41.5 per cent in 1961-62. This improvement in the professional training of the teacher of Mathematics 30 must therefore be considered when assessing student achievement.

The number of Mathematics 30 teachers with less than six years of experience decreased from 1958-59 to 1961-62; the number with more than ten years of experience increased during this period. Therefore, any improvement in student achievement in Grade XII Mathematics could be partially attributed to an improvement in teacher qualification.

TABLE XXI

QUALIFICATIONS OF ZONE MATHEMATICS 30 TEACHERS

YEAR	YEARS OF PROFESSIONAL TRAINING						YEARS OF EXPERIENCE				TOTAL
	<2	≥2<3	≥3<4	≥4<5	≥5<6	>6	0-3	4-6	7-9	10+	
1958-59	1	1	1	27	9	3	2	7	4	29	42
1961-62	2			22	15	2	3	4	3	31	41

From Table XXII it can be seen that the number of Social Studies teachers with four or more years of professional training increased by six from 1958-59 to 1961-62. During this interval there was an increase of four teachers with ten or more years of experience. From the studies conducted by Wasylyk and Lindstedt, (pages 9 and 8), it may be concluded that higher qualifications of the Social Studies 30 teachers in 1961-62 might result in better student achievement.

TABLE XXII

QUALIFICATIONS OF ZONE SOCIAL STUDIES 30 TEACHERS

YEAR	YEARS OF PROFESSIONAL TRAINING						YEARS OF EXPERIENCE				TOTAL
	<2	≧2<3	≧3<4	≧4<5	≧5<6	>6	0-3	4-6	7-9	10+	
1958-59	3	2	12	15	7	3	2	3	9	28	42
1961-62	3	2	5	21	6	4	6	1	2	32	41

Promotion Practices

Regulations regarding the awarding of credits and the requirements of prerequisite courses are contained in the Senior High School Handbook. Standings in non-examination subjects of the high school program are indicated by means of letter gradings as shown in Table IV on page 17. To earn the credit assigned to any course, a student must achieve at least a C standing. This grading enables him to take the succeeding course in English, Literature and Social Studies. However, in all other subjects a student must obtain a B grading before being permitted to enrol in the subsequent course.

The results of the application of the promotion policy are reported in Table XXIII. The failure rates in Social Studies include only the D gradings, whereas in Mathematics they include C and D gradings. The failure rates were consistently lower than the corresponding rates used in the calculation of either the Grade IX or the Grade XII Departmental Examinations. In the Grade IX Departmentals 10 per cent of

the students receive a D grading and 30 per cent a C or D, whereas in Grade XII these percentages are 15 and 40 respectively.

TABLE XXIII

PERCENTAGE OF ZONE STUDENTS FAILING*
IN SOCIAL STUDIES AND MATHEMATICS

YEAR AS OF JUNE	SOCIAL STUDIES 10	SOCIAL STUDIES 20	MATHEMATICS 10	MATHEMATICS 20
1957	6.88	6.34	26.50	21.42
1958	9.95	7.36	30.72	21.79
1959	9.04	8.78	29.76	21.81
1960	7.24	6.02	21.87	24.28
1961	8.20	7.28	24.01	27.80
1962	7.08	5.99	24.99	23.02
MEAN	8.06	6.96	26.31	23.52

*D gradings only in Social Studies; C and D gradings in Mathematics

The failure rates are not consistent in any of the four Grade X and XI subjects, although there is less variation in the two Social Studies courses. The failure rates in the zone are consistently higher in the Grade X subjects than in Grade XI.

Within the zone, of 100 students who registered in Social Studies 10 in 1956-57, 85 per cent were eligible for Social Studies 30 in 1958-59. Likewise, of 100 students registering in Social Studies 10 in 1959-60, 85 per cent were eligible for Social Studies 30 in 1961-62. In Mathematics, 57 per cent of the students were granted a pass between 1956-57 and 1958-59 as compared to 56.5 per cent between 1959-60 and 1961-62.

It may therefore be concluded that in Social Studies no difference in promotion practices existed, whereas in Mathematics, teachers were slightly more selective in 1960-61. However, since this increase in failure rates is very small, its influence will be considered negligible for the purpose of this study.

School Organization

In organizing the high school program and completing Form A cards, the principal is guided by the regulations outlined in the Department of Education Senior High School Handbook. This handbook sets forth the following classifications of High Schools.

TABLE XXIV

CLASSIFICATION OF ALBERTA HIGH SCHOOLS BY TEACHER - GRADE RATIO

CATEGORY	DESCRIPTION
1	One teacher for Grades VII-IX, and some high school subjects
1a	One teacher for Grades IX-X inclusive
1b	One teacher for Grades X-XI inclusive
2a	Two teachers for Grades IX-XII inclusive
2b	Two teachers for Grades X-XII inclusive
3a	Three teachers for Grades IX-XII inclusive
STANDARD	One teacher for each Grade

Table XXV indicates a gradual decrease in the number of schools offering less than a complete high school program from 1958 to 1962, but shows very little change in the number offering a complete program. Most

of this change in organization occurred in the more densely populated areas of the zone. During this four-year period a total of seven schools ceased to offer high school instruction. Three of these schools had previously offered Grade X only; three had provided Grade X and XI, and one had offered Grade X, XI and XII as a 2b high school. Simultaneously with the closing of these schools, four other schools began offering high school instruction. Two of these schools offered Grade X on a standard instructional time basis; the other two added a Grade X class.

TABLE XXV

ORGANIZATION OF ZONE HIGH SCHOOLS BY GRADES OFFERED

YEAR	NUMBER OF SCHOOLS OFFERING GRADE X ONLY	NUMBER OF SCHOOLS OFFERING GRADES X AND XI ONLY	NUMBER OF SCHOOLS OFFERING GRADES X TO XII ONLY	TOTAL
1958-59	5	15	43	63
1959-60	10	12	42	64
1960-61	8	14	41	63
1961-62	6	11	43	60

Over the four-year period the number of schools which offered instruction in Grade XII remained unchanged. Table XXVI shows that two of the 2a and five of the 2b schools disappeared in favour of the 3a and standard schools. It must be pointed out, however, that although the number of schools offering less than standard instruction time decreased from 13 to 9 in the years 1958-59 to 1961-62, the number of Mathematics or Social Studies students attending those schools increased from 96 to 98.

The general trend appears to have been toward a better teacher-grade ratio and toward the establishment of schools in which more efficient use of teacher qualifications was possible.

TABLE XXVI

CLASSIFICATION OF ZONE HIGH SCHOOLS BY TEACHER - GRADE RATIO

YEAR	NO. OF STANDARD SCHOOLS	NO. OF 3a SCHOOLS	NO. OF 2b SCHOOLS	NO. OF 2a SCHOOLS	TOTAL
1958-59	30	2	8	3	43
1961-62	34	5	3	1	43

Class Size

The final variable thought to affect pupil achievement is class size. The enrolments in Mathematics 30 and Social Studies 30 were obtained from the Department of Education Form A cards.

The mean class size, as illustrated in Table XXVII increased from 1959 to 1962 in both subject fields. However, neither of the mean enrolments for 1962 is usually considered to be too large for efficient instruction. Moreover, existing research supplied inconclusive evidence about the influence of class size upon achievement. Because of these two factors, the influence of class size upon achievement is considered negligible for the purpose of this study.

TABLE XXVII

CLASS SIZES WITHIN THE ZONE

	NUMBER OF STUDENTS	NUMBER OF CLASSROOMS	MEAN NUMBER OF STUDENTS
SOCIAL STUDIES 30			
1959	671	46	14.6
1962	992	55	18.0
MATHEMATICS 30			
1959	424	44	9.6
1962	641	46	13.9

VARIABLES TO BE ELIMINATED

Variables which do not differ significantly over the years studied and therefore could not have a marked effect upon pupil achievement are: (1) pupil age, (2) pupil transfer, (3) promotion practice, (4) class size, and (5) school organization.

VARIABLES AFFECTING ACHIEVEMENT

Variables which could have an influence on pupil achievement are: (1) pupil scholastic ability, (2) pupil attendance, and (3) teacher qualifications.

CHAPTER III

CONCLUSIONS AND RECOMMENDATIONS

After weeding out those factors which might affect achievement but which did not show a significant difference in this study, there remain three factors to consider. These factors must therefore be evaluated in their relation to the relative achievement in the two years studied. It should then be possible to determine whether or not the zone testing program has improved achievement.

FACTORS TO BE CONSIDERED

Teacher Qualifications

From 1959-60 to 1961-62 there was a general decline in the number of years of professional training of all high school teachers in the zone. In only one category did this trend vary; the number of teachers with six or more years of training increased. At the same time there was a parallel improvement in the years of professional training and experience among Mathematics and Social Studies teachers between 1959 and 1962.

It has been determined (Wasylyk, page 9) that the greatest effect of teacher qualifications upon student achievement occurs where the teacher has six or more years of training. In view of this factor, and because this study is concerned with achievement in Mathematics and Social Studies, it must be considered that teacher qualifications have

improved during the period investigated.

Pupil Attendance

The mean attendance of 1961-62 students was 7.4 days less than that of the students in 1959-60. This difference is equivalent to approximately seven hours of classroom instruction in each subject and therefore could result in a slight lowering of pupil achievement in 1961-62 compared to 1958-59.

Pupil Ability

The S.C.A.T. test, which measured the abilities of the two Grade XII classes, (Tables XIII and XIV and Figure I, pages 31, 32 and 33 respectively), reveals a superiority of the 1959 Grade XII class. These Tables reveal that the 1962 Grade XII class could not be considered a representative group of the Province since the difference between the S.C.A.T. mean scores for the Province and the zone on the 1958 and 1959 tests greatly exceeded the critical value at the .01 level.

These Tables further indicate that the 1956 Grade IX class could be considered a representative group of the Province since there was no significant difference between S.C.A.T. mean scores for the Province and the zone on the 1956 test. Included in the 1959 Grade XII class were the 75 students who wrote the Dominion Test of Learning Capacity in 1955. These students obtained a mean score which was significantly below that of the Province. Since the difference between the Dominion mean scores for the Province and the zone exceeded the critical value only slightly, it can be concluded that these 75 students were superior to either of the

classes who wrote the ability tests in 1958 or 1959.

The difference in ability of the two classes is further illustrated by the achievement in Grade IX Mathematics and Social Studies (Table XV, page 34). This Table shows that 78.54 per cent of the 1959 Grade XII class made H and A gradings in Grade IX Mathematics compared to 67.23 per cent in 1962. In Social Studies, 57.53 per cent of the 1959 Grade XII class made H and A Grade IX gradings as compared to 48.69 per cent of the 1962 Grade XII class. Black (page 29) concluded that Grade IX results may be used to predict success in related courses; therefore the achievement of the 1959 Grade XII class should have exceeded that of the 1962 Grade XII class.

It may be concluded then that the 1959 Grade XII class was superior in ability to the 1962 Grade XII class.

COMPARISON OF FAILURE RATES

Of the students registering in Grade XII, some desire only a high school diploma, while the others are working for a senior matriculation. It is therefore necessary to consider the failure rates in relation to each type of certificate.

In order to secure a high school diploma a student must have at least a C grading in each Grade XII subject. For this certificate, therefore, a D means a failure. From Table VII, page 25, it can be seen that there were 6.1 per cent more failures in Mathematics 30 in 1962 than in 1959, and 7.1 per cent more failures in Social Studies 30 in 1962.

At least a B grading in all Grade XII academic subjects is required for senior matriculation. For this certificate a C or a D is a failure. Table VII, page 25, shows that there were 6.2 per cent more failures in Mathematics 30 in 1962 than in 1959, and 5.3 per cent more failures in Social Studies 30 in 1962.

There were 11 per cent more of the 1962 Grade XII Mathematics class who had received B and C gradings in Grade IX than of the 1959 Grade XII class, but only 6.2 per cent more students failed to secure a senior matriculation score in 1962 than in 1959. In Social Studies, 9 per cent more of the 1962 Grade XII class had received B and C gradings in Grade IX than of the 1959 Grade XII class, but only 5.3 per cent more of the 1962 students failed to secure a senior matriculation score. Although the failure rates of the 1962 class showed an increase over those of the 1959 class, in neither subject was this increase as great as the difference between the percentage of the 1962 and 1959 students who received B and C gradings in the Grade IX examinations. The gap in level of achievement for the two groups had been narrowed from Grade IX to Grade XII.

COMPARISON OF ACHIEVEMENTS

Table V, page 24, shows the achievement in Grade XII Mathematics for the two years. The mean obtained by the zone students in 1959 (55.55) was significantly higher than the mean for the Province (53.26). In 1962 there was no significant difference between the two means (52.92,

53.60). Therefore the mean for the zone in relation to the Province was lower in 1962 than in 1959.

The ability of the 1962 Grade XII class in the zone (Table XIV, page 32) was significantly lower at the .01 level than that of the 1962 class in the Province. Therefore a significant difference between the Grade XII achievement in the zone and the Province could have been anticipated, but no significant difference was found between the mean scores in Mathematics.

The Mathematics mean scaled scores for the Province did not differ significantly in the two years. However, the mean scaled score for the zone in 1962 was significantly below that of the zone in 1959.

Table VII, page 25, shows that in 1959 the zone students received a greater percentage of A gradings, and a lower percentage of D gradings in Mathematics 30 than the students of the Province, whereas the percentage of A's and D's for the two groups differed very little in 1962. This difference in achievement was further substantiated by the chi-square test which compared the observed frequency in each letter grading with the expected frequency (Tables VIII and IX).

Table VI, page 24 shows the achievement in Grade XII Social Studies for the two years. The mean score obtained by the zone students in 1959 (52.92) was significantly lower, at the .05 level, than the mean for the Province (54.31). In 1962 the mean for the zone (49.72) was significantly lower, at the .01 level, than the mean for the Province (54.15). There was no difference between the means for the Province in 1959 and 1962. The mean for the zone in 1962 was significantly lower

than the mean for the zone in 1959. Therefore the Social Studies achievement for the zone was lower in 1962 than in 1959.

Table VII, page 25, shows that in 1959 and 1962 the percentage of zone students receiving an H grading in Social Studies was below that of the Province. This Table further reveals that the zone students in 1962 received a lower percentage of A gradings, and a higher percentage of D gradings than the students of the Province, whereas the percentage of A's and D's for the two groups differ very little in 1959. This difference is further illustrated by the chi-square test which compared the observed frequency in each letter grading with the expected frequency (Tables X and XI).

EVALUATION OF THE HYPOTHESIS

The hypothesis of this study was that the zone examinations in Central Alberta would improve student achievement in Grade XII. This study has revealed that there was a decrease in achievement and an increase in the failure rate of the 1962 class as compared to the 1959 class. However, in view of the lower ability of the 1962 class, their lower achievement in Grade IX Mathematics and Social Studies, and their lower attendance record, a considerable increase in the failure rate was to be expected. Taking these factors into consideration, it seems that the increase in failure rates was not as great as might have been anticipated. This fact can be attributed to two factors: the improvement in qualifications of Mathematics and Social Studies teachers, and the zone testing program.

Though there is some indication that the zone testing program, along with improved teacher qualifications, may have prevented the 1962 Grade XII results from dropping as far as they might otherwise have fallen, there is no positive evidence that the zone testing program has improved achievement. More evidence would have been available through an analysis of covariance using ability and achievement as variables. This analysis was not conducted, however, because the ability tests used in 1955, 1956, 1958 and 1959 were of three types, thus making any conclusions invalid. It must therefore be concluded that the hypothesis for this study has not been proven either true or false.

RECOMMENDATIONS

The zone testing program as instituted in Central Alberta had several aims, only one of which has been dealt with in this study. It has yet to be determined to what extent the other aims have been met. In order to assess the program more fully, further study would be necessary to measure the influence of the program upon other aspects of education.

In accordance with the rules governing zone testing in the Central Alberta Zone, all examinations have been held at the end of June. Administered at this time, the sole use of the tests has been to help determine promotion or failure. This practice renders the tests useless as a means of determining difficulties and as a tool of diagnostic teaching. Holding the tests earlier in the year would enable

the teachers to use them as teaching aids, thus bringing about greater mastery of subject matter. Used as a tool for diagnostic teaching, the zone testing program could enhance instruction, thereby arriving at its aim of improving achievement. Used in this capacity, new examinations each year would be unnecessary. Consideration should therefore be given by teachers, principals, and superintendents to holding the examinations at a more advantageous time.

An achievement test is an instrument designed to measure relative accomplishments in a specified area of work. The achievement tests written under the zone testing program have been mainly objective type tests. As such, they have tended to favour the quick, superficially clever person who has a retentive memory for isolated facts and to penalize the more reflective, profound person with gifts of originality. Therefore, some consideration should be given to the possibility of including a greater proportion of subjective questions in each examination. The test might then be a truer measure of the various facets of a student's skill and knowledge.

Accurate assessment of a pupil's achievement and thus the correct diagnosis of his needs is dependent upon the quality of examinations. Some program which would improve the quality of examinations should be undertaken. This might consist of greater guidance by an expert in the field in the setting of examinations, or in-service training of teachers in the preparation of examinations. In support of this recommendation Nash made the following statement,[32]

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[32]P. Nash, "Assumptions and Consequences of Objective Examinations," (Saskatchewan Bulletin, 1962), p. 30.

> The validity and reliability of objective examinations can be drastically reduced by carelessness or ignorance on the part of the examiner. Considerable expertness is necessary to avoid falling into serious pitfalls. When the examination is composed by the average teacher, it probably contains many questions which are misleading, improperly or ambiguously worded, or which do not test what they are supposed to test.

Also in support of this recommendation Micheals and Karnes[33] when discussing test construction listed the following points as requisites of a good test,

1. A good test must actually measure what it is supposed to measure. (validity)
2. It must do this accurately and consistently. (reliability)
3. It must be fair to the students. (objectivity)
4. It must pick out the good students from the poor. (discrimination)
5. It must be long enough to do the job. (comprehension)
6. It must be easy to use. (ease of administration and scoring)

If the use of external examinations becomes more prevalent, the current study has implications for teacher training institutions. Perhaps teacher training institutions should place greater emphasis on courses in educational measurement and testing than now exists. Mayo,[34] in support of this recommendation reported that,

> V. H. Noll surveyed requirements for measurement courses for certification in the various states and the course each offered in measurement in 80 selected teacher-training institutions of

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[33] W. J. Micheals and M. R. Karnes, "Measuring Educational Achievement," (McGraw-Hill, 1950) pp. 103-104.

[34] S. T. Mayo, "Testing and the Use of Test Results," (Review of Educational Research, Vol. 29, 1956) p. 6.

> four types; large public, large private, state teachers college, and liberal arts colleges. He found that 83% offered an introductory course in measurement. Of these, however, only 41% required the course of all undergraduates preparing for certain types of certificates.

Although only two subjects have been investigated in this study, seven other Grade X and XI courses were included in the testing program. It has resulted in a rather extensive use of external examinations. Consideration should therefore be given to various methods of delimiting the program and to a greater use of internal examinations. MacArthur,[35] in his recommendations to the Alberta Royal Commission in Education, had this to say about external examinations,

> Excessive use of external examinations tends to narrow the aims of teaching to that which can be tested by pencil-and-paper examinations, to interfere with adaptation of the curriculum to either local conditions or to wide differences in pupils, and along with other forms of centralization to "imply the negation of all that goes to make good teaching." Just what constitutes excessive use of such examinations in any particular setting is a matter of judgment, but it is good educational administration to keep the use of external examinations at a minimum, while at the same time facilitating and encouraging the use of efficient internal examinations.

The current research has failed to prove that the zone testing program as practiced in Central Alberta has improved achievement. This conclusion, however, does not imply that the program has no merit and must be scrapped without further ado. Before taking this step educators within the zone should attempt to: (1) ascertain the extent to which the program has achieved its other aims; (2) improve the quality of examinations; and (3) adapt the program for use as a tool for improving instruction.

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[35]MacArthur and Hunka, op. cit., p. 49.

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